



Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 5NZ7 / pdb_00005nz7
Title : Clostridium thermocellum cellodextrin phosphorylase ligand free form
Authors : O'Neill, E.C.; Pergolizzi, G.; Stevenson, C.E.M.; Lawson, D.M.; Nepogodiev, S.A.; Field, R.A.
Deposited on : 2017-05-12
Resolution : 2.30 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

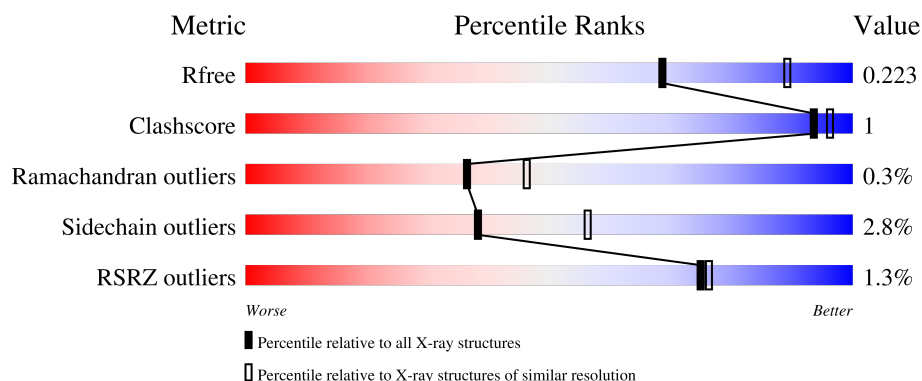
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	1009	% 92% 5% .
1	B	1009	% 91% 5% .

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 15347 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Cellodextrin phosphorylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	984	Total	C	N	O	S	0	0	0
			7596	4878	1259	1427	32			
1	B	978	Total	C	N	O	S	0	0	0
			7512	4819	1252	1409	32			

There are 50 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-24	MET	-	initiating methionine	UNP Q93HT8
A	-23	GLY	-	expression tag	UNP Q93HT8
A	-22	SER	-	expression tag	UNP Q93HT8
A	-21	SER	-	expression tag	UNP Q93HT8
A	-20	HIS	-	expression tag	UNP Q93HT8
A	-19	HIS	-	expression tag	UNP Q93HT8
A	-18	HIS	-	expression tag	UNP Q93HT8
A	-17	HIS	-	expression tag	UNP Q93HT8
A	-16	HIS	-	expression tag	UNP Q93HT8
A	-15	HIS	-	expression tag	UNP Q93HT8
A	-14	SER	-	expression tag	UNP Q93HT8
A	-13	SER	-	expression tag	UNP Q93HT8
A	-12	GLY	-	expression tag	UNP Q93HT8
A	-11	LEU	-	expression tag	UNP Q93HT8
A	-10	VAL	-	expression tag	UNP Q93HT8
A	-9	PRO	-	expression tag	UNP Q93HT8
A	-8	ARG	-	expression tag	UNP Q93HT8
A	-7	GLY	-	expression tag	UNP Q93HT8
A	-6	SER	-	expression tag	UNP Q93HT8
A	-5	HIS	-	expression tag	UNP Q93HT8
A	-4	MET	-	expression tag	UNP Q93HT8
A	-3	LEU	-	expression tag	UNP Q93HT8
A	-2	GLU	-	expression tag	UNP Q93HT8
A	-1	ASP	-	expression tag	UNP Q93HT8
A	0	PRO	-	expression tag	UNP Q93HT8

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-24	MET	-	initiating methionine	UNP Q93HT8
B	-23	GLY	-	expression tag	UNP Q93HT8
B	-22	SER	-	expression tag	UNP Q93HT8
B	-21	SER	-	expression tag	UNP Q93HT8
B	-20	HIS	-	expression tag	UNP Q93HT8
B	-19	HIS	-	expression tag	UNP Q93HT8
B	-18	HIS	-	expression tag	UNP Q93HT8
B	-17	HIS	-	expression tag	UNP Q93HT8
B	-16	HIS	-	expression tag	UNP Q93HT8
B	-15	HIS	-	expression tag	UNP Q93HT8
B	-14	SER	-	expression tag	UNP Q93HT8
B	-13	SER	-	expression tag	UNP Q93HT8
B	-12	GLY	-	expression tag	UNP Q93HT8
B	-11	LEU	-	expression tag	UNP Q93HT8
B	-10	VAL	-	expression tag	UNP Q93HT8
B	-9	PRO	-	expression tag	UNP Q93HT8
B	-8	ARG	-	expression tag	UNP Q93HT8
B	-7	GLY	-	expression tag	UNP Q93HT8
B	-6	SER	-	expression tag	UNP Q93HT8
B	-5	HIS	-	expression tag	UNP Q93HT8
B	-4	MET	-	expression tag	UNP Q93HT8
B	-3	LEU	-	expression tag	UNP Q93HT8
B	-2	GLU	-	expression tag	UNP Q93HT8
B	-1	ASP	-	expression tag	UNP Q93HT8
B	0	PRO	-	expression tag	UNP Q93HT8

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	3	Total Cl 3 3	0	0
2	B	3	Total Cl 3 3	0	0

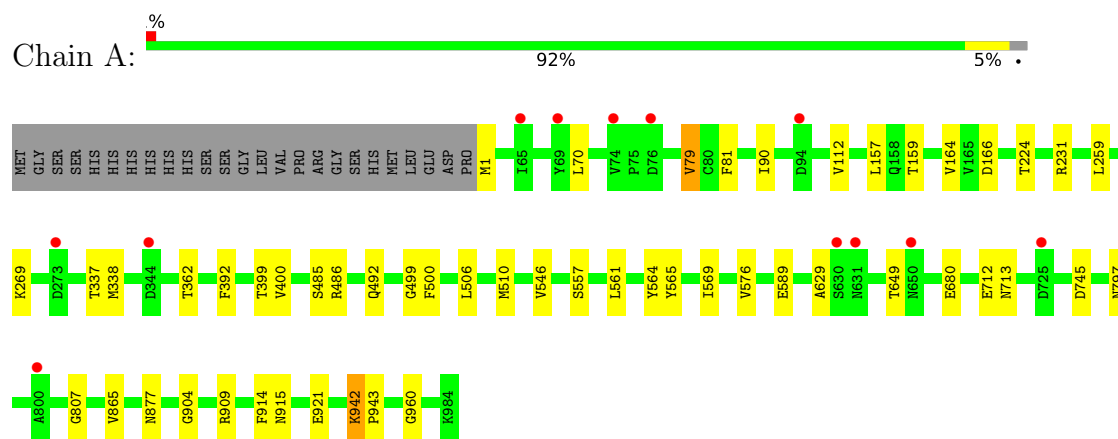
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	119	Total O 119 119	0	0
3	B	114	Total O 114 114	0	0

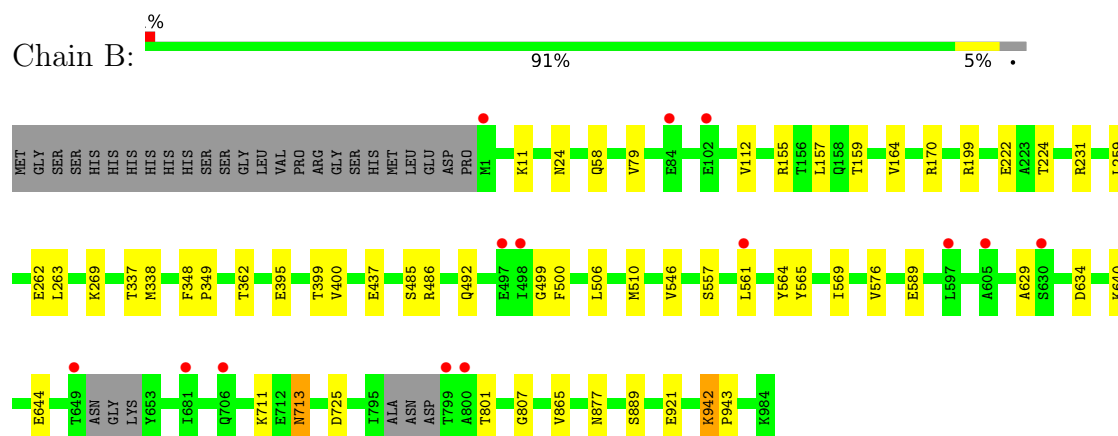
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: Cellodextrin phosphorylase



• Molecule 1: Cellodextrin phosphorylase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	84.64Å 151.81Å 91.97Å 90.00° 114.60° 90.00°	Depositor
Resolution (Å)	47.65 – 2.30 47.65 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.5 (47.65-2.30) 99.5 (47.65-2.30)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.49 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5	Depositor
R, R_{free}	0.191 , 0.223 0.191 , 0.223	Depositor DCC
R_{free} test set	4668 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	55.4	Xtriage
Anisotropy	0.303	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 31.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.025 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	15347	wwPDB-VP
Average B, all atoms (Å ²)	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.16% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CL

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.60	0/7770	0.76	0/10569
1	B	0.59	0/7683	0.76	0/10449
All	All	0.60	0/15453	0.76	0/21018

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	7596	0	7189	23	0
1	B	7512	0	7064	17	0
2	A	3	0	0	0	0
2	B	3	0	0	1	0
3	A	119	0	0	1	0
3	B	114	0	0	0	0
All	All	15347	0	14253	40	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 1.

All (40) close contacts within the same asymmetric unit are listed below, sorted by their clash

magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:199:ARG:NE	1:B:262:GLU:OE2	2.21	0.69
1:A:680:GLU:HG2	1:A:909:ARG:HD3	1.77	0.66
1:A:269:LYS:CB	1:A:399:THR:HG22	2.35	0.56
1:B:269:LYS:CB	1:B:399:THR:HG22	2.37	0.55
1:A:112:VAL:HG12	1:A:112:VAL:O	2.07	0.55
1:A:79:VAL:CG1	1:A:90:ILE:HD11	2.37	0.54
1:A:506:LEU:O	1:A:510:MET:HB2	2.08	0.53
1:B:170:ARG:HH11	1:B:170:ARG:HG2	1.73	0.53
1:B:112:VAL:O	1:B:112:VAL:HG12	2.09	0.53
1:B:506:LEU:O	1:B:510:MET:HB2	2.08	0.52
1:B:486:ARG:O	1:B:492:GLN:HG2	2.10	0.51
1:A:486:ARG:O	1:A:492:GLN:HG2	2.14	0.48
1:A:392:PHE:CD2	1:A:400:VAL:HG21	2.49	0.48
1:A:79:VAL:HG11	1:A:90:ILE:HD11	1.95	0.47
1:A:564:TYR:HE1	1:A:576:VAL:CG1	2.29	0.46
1:A:81:PHE:CE1	1:A:90:ILE:HD13	2.51	0.46
1:B:564:TYR:HE1	1:B:576:VAL:CG1	2.29	0.45
1:B:565:TYR:CZ	1:B:569:ILE:HG13	2.52	0.45
1:A:745:ASP:OD1	1:A:745:ASP:C	2.59	0.45
1:A:81:PHE:CE1	1:A:90:ILE:CD1	3.00	0.45
1:A:337:THR:HG22	1:A:338:MET:N	2.32	0.45
1:B:337:THR:HG22	1:B:338:MET:N	2.32	0.45
1:B:499:GLY:O	1:B:500:PHE:C	2.59	0.45
1:B:889:SER:HB2	2:B:1003:CL:CL	2.54	0.45
1:A:942:LYS:HG3	1:A:943:PRO:O	2.18	0.44
1:B:942:LYS:HG3	1:B:943:PRO:O	2.18	0.44
1:A:70:LEU:HD21	1:A:81:PHE:CE2	2.53	0.43
1:A:159:THR:HB	1:A:259:LEU:HD11	2.00	0.43
1:B:159:THR:HB	1:B:259:LEU:HD11	2.01	0.43
1:B:711:LYS:O	1:B:713:ASN:N	2.44	0.43
1:A:565:TYR:CZ	1:A:569:ILE:HG13	2.54	0.42
1:A:915:ASN:ND2	3:A:1105:HOH:O	2.51	0.42
1:A:81:PHE:CD1	1:A:90:ILE:HD12	2.54	0.42
1:B:348:PHE:HB3	1:B:349:PRO:CD	2.50	0.41
1:B:807:GLY:O	1:B:877:ASN:HA	2.21	0.41
1:A:807:GLY:O	1:A:877:ASN:HA	2.21	0.41
1:B:640:LYS:O	1:B:644:GLU:HG3	2.21	0.41
1:A:499:GLY:O	1:A:500:PHE:C	2.64	0.40
1:A:904:GLY:O	1:A:914:PHE:HA	2.22	0.40
1:A:166:ASP:OD1	1:A:166:ASP:C	2.64	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	982/1009 (97%)	940 (96%)	39 (4%)	3 (0%)	36	46
1	B	972/1009 (96%)	932 (96%)	37 (4%)	3 (0%)	36	46
All	All	1954/2018 (97%)	1872 (96%)	76 (4%)	6 (0%)	36	46

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	629	ALA
1	A	649	THR
1	B	11	LYS
1	B	629	ALA
1	A	960	GLY
1	B	725	ASP

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	768/872 (88%)	750 (98%)	18 (2%)	44	63
1	B	753/872 (86%)	728 (97%)	25 (3%)	33	50
All	All	1521/1744 (87%)	1478 (97%)	43 (3%)	38	56

All (43) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	79	VAL
1	A	157	LEU
1	A	164	VAL
1	A	224	THR
1	A	231	ARG
1	A	362	THR
1	A	485	SER
1	A	546	VAL
1	A	557	SER
1	A	561	LEU
1	A	589	GLU
1	A	712	GLU
1	A	713	ASN
1	A	797	ASN
1	A	865	VAL
1	A	921	GLU
1	A	942	LYS
1	B	24	ASN
1	B	58	GLN
1	B	79	VAL
1	B	155	ARG
1	B	157	LEU
1	B	164	VAL
1	B	222	GLU
1	B	224	THR
1	B	231	ARG
1	B	263	LEU
1	B	362	THR
1	B	395	GLU
1	B	400	VAL
1	B	437	GLU
1	B	485	SER
1	B	546	VAL
1	B	557	SER
1	B	561	LEU
1	B	589	GLU
1	B	634	ASP
1	B	713	ASN
1	B	801	THR
1	B	865	VAL
1	B	921	GLU

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Mol	Chain	Res	Type
1	B	942	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	43	ASN
1	A	193	ASN
1	A	331	GLN
1	A	515	ASN
1	A	542	ASN
1	A	896	ASN
1	A	915	ASN
1	B	43	ASN
1	B	58	GLN
1	B	193	ASN
1	B	253	HIS
1	B	331	GLN
1	B	515	ASN
1	B	793	ASN
1	B	896	ASN
1	B	926	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 6 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	984/1009 (97%)	0.00	12 (1%) 76 77	39, 61, 92, 128	0
1	B	978/1009 (96%)	0.10	14 (1%) 73 75	38, 68, 107, 131	0
All	All	1962/2018 (97%)	0.05	26 (1%) 75 76	38, 64, 101, 131	0

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	649	THR	3.8
1	A	800	ALA	3.7
1	A	344	ASP	3.4
1	A	725	ASP	3.2
1	B	681	ILE	3.1
1	B	799	THR	3.0
1	B	597	LEU	2.9
1	B	497	GLU	2.9
1	A	630	SER	2.8
1	B	1	MET	2.7
1	B	800	ALA	2.7
1	B	605	ALA	2.6
1	A	650	ASN	2.5
1	A	74	VAL	2.5
1	B	498	ILE	2.4
1	A	94	ASP	2.3
1	A	65	ILE	2.3
1	A	631	ASN	2.3
1	B	630	SER	2.2
1	A	69	TYR	2.2
1	A	76	ASP	2.1
1	B	102	GLU	2.1
1	A	273	ASP	2.1
1	B	84	GLU	2.0

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Mol	Chain	Res	Type	RSRZ
1	B	706	GLN	2.0
1	B	561	LEU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	CL	A	1003	1/1	0.90	0.10	75,75,75,75	0
2	CL	B	1002	1/1	0.96	0.09	67,67,67,67	0
2	CL	B	1003	1/1	0.97	0.11	72,72,72,72	0
2	CL	A	1002	1/1	0.98	0.07	52,52,52,52	0
2	CL	A	1001	1/1	0.99	0.06	46,46,46,46	0
2	CL	B	1001	1/1	0.99	0.03	43,43,43,43	0

6.5 Other polymers [i](#)

There are no such residues in this entry.